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GROWING SOYBEANS in Oklahoma

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W. L. Blizzard, Director Louis E. Hawkins, Vice Director

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Suggestions for Producing Soybeans

These suggestions apply chiefly to soybeans grown to be harvested for the beans. For growing soybeans as a forage crop, see pages 15 and 16.

Select a soil that will produce a medium to high yield of corn. Soybeans will not make profitable yields of seed on soils of low fertility.

Prepare a good seedbed early in the spring and destroy at least two crops of weeds by disking or cultivating before planting.

Plant inoculated seed at the rate of one viable seed about every two inches in rows 36 to 42 inches

Plant seed of recommended varieties. The only varieties recommended in Oklahoma at this time are S-100 and Ogden.

The best time of planting is from May 10 to June 1.

Keep the crop free of weeds by cultivation.

Combine as soon as seed are mature and low enough in moisture content for safe storage. If combining is delayed after the beans mature, some losses may occur from shattering. Adjust the combine to avoid splitting of seed as they become drier during the day.

Bulletins reporting the Station's tests on soybean varieties and on date of planting soybeans are being prepared for publication.

On the Cover

Ogden soybeans, one of the recommended varieties for Oklahoma, matured and ready for combining.

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GROWING SOYBEANS in Oklahoma

By CHESTER L. CANODE*
Assistant Agronomist

The many uses of soybeans developed in the past few years have made it one of the major cash grain crops in the United States, with production centering in the Corn Belt states.

Soybeans are still a minor crop in Oklahoma, but there is increasing interest in them. Evidence that the soybean is finding a place as a grain crop in the agriculture of this State is given in Figure 1.

Soybeans were first grown in Oklahoma mostly for hay. In 1942, there was a decided change toward seed production, because of the wartime demand for oil crops and protein feed; but the dry summer of 1943, and the use of forage-type varieties which produced low seed yields, discouraged many growers.

Soybean variety tests conducted by the Oklahoma Agricultural Experiment Station** indicate that some of the varieties now available will give reasonably good yields of seed when grown on land suitable for raising corn. The varieties, Ogden and S-100, are well adapted for seed production under Oklahoma conditions. The national market for soybeans appears to be here to stay, although the place of the crop in Oklahoma's agriculture remains to be seen. In any case, Oklahomans are showing a renewed interest in growing soybeans as a "cash grain" crop. Therefore this bulletin was prepared to summarize information available from research and observation at the Oklahoma Station.

Uses of Soybeans

Feed for Livestock

The soybean when properly handled makes an excellent high protein hay. The chief objection to this crop for forage is the coarse stems, which cause difficulty in curing and usually are not entirely consumed by animals. The part of the soybean plant eaten by animals has approximately the same feeding value as alfalfa hay of a similar grade.

Soybeans make a desirable pasture crop and are often grown with corn for "hogging off." The crop can also be used for silage, but it is necessary to use a preservative such as molasses or phosphoric acid to produce a good quality feed. Corn, sorghum or other highly carbonaceous material can be used in

* The author gratefully acknowledges the assistance of farmers, county agents and agronomists who have cooperated in soybean testing in Oklahoma. Credit is due especially to Prof. Hi W. Staten, who was in charge of soybean research from 1942 to 1948 for the Oklahoma Agricultural Experiment Station. The variety test data reported in this publication was obtained in cooperation with the U. S. Regional Soybean Laboratory, Bureau of Plant Industry, Soils and Agricultural Engineering, Agricultural Research Administration, U. S. Department of Agriculture.

** A bulletin reporting these tests is now being prepared for publication. The results are summarized briefly on page 10.

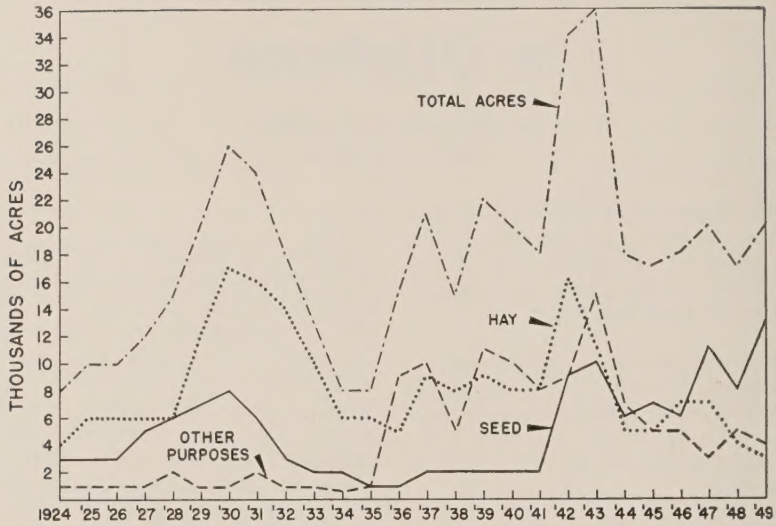


Fig. 1.—Oklahoma soybean acreages are shown above for the years 1924 to 1949. The increase in seed acreage since 1946 indicates the growing interest in soybeans as a grain crop in this state. (Data supplied by Office of Agricultural Statistician, U. S. D. A., Oklahoma City, Okla.).

place of the preservatives in producing a high grade silage.

Unprocessed soybean seed can be fed to livestock as a protein supplement. However, if it is fed to swine it will produce "soft pork" which will result in a lower market price for the pigs. Due to the value of the oil it is generally more profitable for the grower to sell his seed and then purchase the soybean meal for feeding his livestock.

The meal left after the oil has been removed from the seed is high in protein. Feeding tests at this and other experiment stations have shown that the protein is of good quality and that it compares favorably with other vegetable protein feeds. After the oil is removed the soybean meal can be fed without danger of producing "soft pork" in swine.

Food for Human Consumption

The soybean, rich in protein, minerals and vitamins, has an extremely high food value. The whole beans of edible varieties can be used as a vegetable in many different ways.

At the present time 70 to 85 percent of the soybean oil in the United States is being used by the food industry. This oil enters extensively into the production of compounds and margarines. Other products manufactured or processed from soybeans are beverages, breakfast foods, meat-like products, milk substitutes (liquid and powder), soy sauce, cookies, crackers, toast, flour, flakes, diabetic foods, infant foods, salad oils, cooking oils, toppings, and whipping agents.

Industrial Uses

In addition to the great many food products manufactured by about 200 companies, more than 100 manufacturers are turning out various industrial

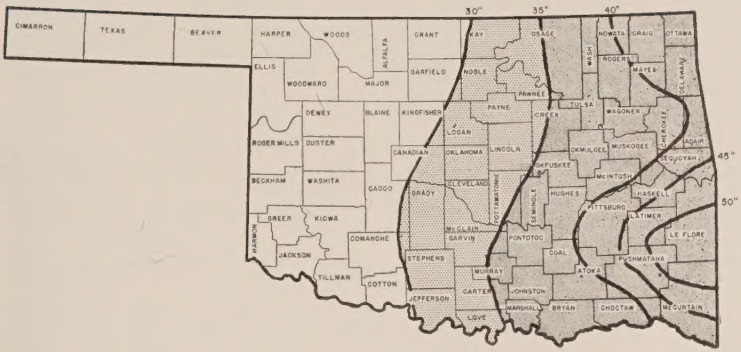


Fig. 2.—Soybeans are adapted to the area receiving 35 inches or more rainfall annually. They can be grown in the central area of the state (30 to 35 inches of rainfall), but the seed yields usually are restricted by dry weather. Soybeans are not adapted to the area in Oklahoma receiving an annual rainfall of less than 30 inches.

products from this bean.* Some of the products in which soybean oil is being used are soap, cleaning compounds, disinfectants, foundry oil, paint, enamels, varnishes, linoleum, oil cloth, printing ink, grease, lubricating compounds, rubber substitutes, patent and artificial leather, waterproof fabric, glycerin, lecithin, medicinal oil, sticker for sprays, waterproofing cement, pharmaceuticals, cosmetics, special emulsifier, petroleum products, plastic compositions and textiles.

The meal left after the oil is removed from the seed is a valuable product in itself. In addition to its high protein value as livestock and human food, it is manufactured into many products such as adhesives, textile fiber (artificial wool), spreader for insect sprays, finishing wax, paper-sizing material, celluloid substitutes, plastics, water paint, and waterproofing for textiles.

Soil and Climatic Adaptation

Soybeans are adapted to practically the same climate and soil conditions as corn. Any soil that will produce good yields of corn will also produce good yields of soybeans. In addition, soybeans if well nodulated can be grown on soil too low in available nitrogen to produce satisfactory yields of corn without heavy applications of fertilizer. They will, in general, stand more wet weather and are not as seriously injured by drouth as corn.

Soybeans will grow well on soils that are too acid for the production of alfalfa or sweet clover, but they will respond favorably to applications of lime. They are not as well adapted to heavy clay soils or sandy soils as are cowpeas.

The climatic adaptation of soybeans restricts their profitable production to an area receiving 35 inches or more rainfall annually, or roughly the eastern half of Oklahoma (Figure 2).

The seed yield and oil content of Ogden variety soybeans grown on soils of different fertility levels are shown

* Morse, W. J., *"Soybeans Yesterday and Today."* Foreign Agriculture XII: 91-96, 1948

TABLE I.—Seed Yield and Oil Content of Ogden Soybeans Grown on Soils of Different Fertility Levels.

Fertility Level*	Seed Yields (bushels per acre)				Oil in Seeds (Percent)			
	1944	1945	1946	Av.	1944	1945	1946	Av.
Low	9.5	18.4	11.6	13.2	22.5	20.7	19.5	20.9
Medium	21.3	12.1	31.7	21.7	19.4	19.3	20.0	19.6
High	43.2	37.5	33.9	38.2	21.1	19.8	20.5	20.5

*Low: Heavener, Oklahoma (upland)
Medium: Stillwater, Oklahoma (bottom land)
High: Coweta, Oklahoma (bottom land)

in Table I. The seed yields were affected very little by the more favorable rainfall received by the low fertility plots. The oil content was higher for the beans grown under more favorable rainfall conditions, but was influenced little if any by the fertility level.

Effect of Soybeans on the Soil

Nitrogen

The soybean, when properly nodulated, gets most of its nitrogen from the air. When it is harvested with a combine, removing only the seed, it does not deplete the soil of nitrogen. In Illinois* it has been determined that soybeans producing a 20-bushel seed crop will add 16 pounds of nitrogen per acre, while a 40-bushel corn crop will remove 40 pounds and a 40-bushel oat crop will remove 26 pounds. It is likely that the amount of nitrogen added to the soil by soybeans would be smaller in Oklahoma, because climatic conditions are not as favorable for bacterial activity. But, at least, soybeans will provide most of their own supply of nitrogen, which is the most expensive fertilizer element when purchased.

Other Plant Nutrients

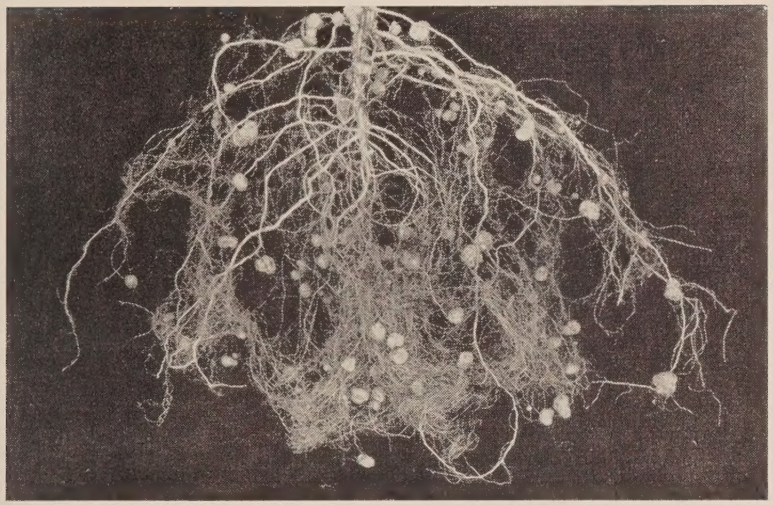
The soybean, like all other crops, draws heavily on other plant nutrients, especially phosphorus, potassium and calcium. In comparison with a 40-bushel corn crop, a 20-bushel soybean seed crop removes about the same amount of phosphorus and magnesium, about three times as much potassium, and about eight times as much calcium.*

Tilth

The soybean is an outstanding crop for improving soil tilth. The large amount of vegetative growth helps keep down weeds, shades the soil to prevent crusting, and adds organic matter. After the soybean seed crop is removed by combining, the ground is loose and friable and is usually in good condition for seeding fall-sown small grains. However, some soils may be *too* loose and need firming to make a good seedbed for a small-grain crop, especially winter oats.

Some soils have a tendency to "run together" if fall plowed after soybeans and not cropped during the winter. To avoid this, it would be better to delay plowing of soybean land until the following spring unless a crop is to be planted immediately after the soybeans are removed.

* Sears, O. H., *Soybeans—Their Effect on Soil Productivity.* Illinois Agri. Exp. Sta. Bul. 456 (1939).



Roots of soybean plant showing abundant development of nodules. (Picture courtesy U. S. Regional Soybean Laboratory.)

Erosion

When soybeans are planted in rows and cultivated, the soil is left almost free of weeds and in a loose condition. On sloping land that is subject to erosion, soybeans should be planted only when good soil conservation practices can be used. Planting on the contour and following the crop with a winter cover crop will help reduce soil erosion losses. It may be necessary to use an early maturing variety such as S-100 so the crop can be harvested in time to successfully establish the winter cover crop.

Fertilization and Liming

As a general rule, soybeans grown for seed on soils of average to high fertility do not respond as well as other crops to applications of fertilizers. On most soils it would be more profitable to apply fertilizer to other crops in the rotation.

Soybeans for seed production are not recommended for sandy soils or soils of low fertility. If they are grown on these soils, and application of approximately 200 pounds of superphosphate, 0-14-7, 0-12-12, 2-12-6 or 4-12-4 made in the row would be sufficient in most cases.* Soybeans grown for forage will respond favorably to fertilizer applications, especially when grown on soils of low fertility.

In applying fertilizer (other than superphosphate) in the row, care should be taken to keep the fertilizer from coming in direct contact with the seed.

The soybean will tolerate an acid soil condition better than alfalfa or sweet clover, but will respond well to

* Harper, H. J., *et al, Fertilizer Recommendations for Oklahoma Crops,* Okla. Agri Exp. Sta. Bul. B-326 (1949).

applications of lime on acid soils. Inoculation and the activity of the bacteria in the nodules are favored by soils that are not acid in reaction.

Inoculation

The soybean with proper nodule development will secure about two-thirds of its nitrogen from the air. In general, the bacteria which cause nodules on other common legumes will not inoculate soybeans, nor will the soybean bacteria inoculate other legumes. It is therefore necessary to inoculate the seed if it is being planted on soil that has not produced a crop of well nodulated soybeans within the preceding three to four years. Due to the low cost and the ease of applying the cultures, it is advisable to inoculate the seed each year. This is especially true in soils that are slightly acid to acid, as the bacteria which produce nodulation decrease very rapidly under these conditions.

Some varieties of soybeans are more difficult to nodulate than others, as they may not be readily inoculated by strains of bacteria adapted to other varieties. It may be necessary to inoculate seed for two to three years before good nodulation is produced, even when it is grown on the same soil each year.

Varieties

Selection of the right variety is one of the most important factors in successful soybean production. Due to the wide variation in maturity of the numerous varieties available, only a relatively small number are adapted to Oklahoma climatic conditions. When the early maturing varieties used in the northern part of the United States are grown in Oklahoma, they mature during the hot, dry part of the summer and usually make very low yields of forage and seed. The late maturing varieties adapted to the extreme southern states usually make good vegetative growth in Oklahoma, but are likely to be killed by frost before they mature seed.

Soybean variety tests have been conducted in Oklahoma since 1918. At first, the major emphasis was on forage production; and, as a result of the earlier tests, varieties were recommended that made good forage yields but were very low in seed yield and oil content. More recently, new uses of soybean oil in industry, and the value of the high protein meal, have created a demand for soybean varieties that would produce good yields of seed having high oil content. To meet this demand, many new varieties of soybeans were developed by the state agricultural experiment stations in cooperation with the United States Department of Agriculture.

On the basis of tests conducted at several different locations in Oklahoma, *Ogden and S-100 are the only varieties of soybeans recommended for this State at the present time.* Ogden, in addition to making high seed yields, has also proved a desirable variety for hay production and is therefore recommended as a forage variety.

Odgen is a medium late variety, maturing about October 15 in this State. The seeds are olive yellow, average about 3,000 seeds per pound, and have an oil centent of approximately 20.5 percent. The plants have an upright, bunchy type of growth and usually do not lodge.

S-100 is primarily a grain type plant. It is earlier than Ogden, maturing

about September 25 in Oklahoma. The seeds are straw yellow, average about 3,400 to the pound, and have an oil content of approximately 19.0 percent. The plants have an erect, upright growth with few side branches; this makes the variety very desirable for combine harvesting. Although S-100 on the average has not produced seed yields as high as Ogden at the different test locations (Table II,) it is still a very desirable variety because of its early maturity and ease of harvesting. In some years when rainfall conditions are unfavorable in August and September, S-100 will make better yields than the later maturing varieties. The earlier maturity of S-100 also makes it a good variety to use in a rotation where soybeans are to be followed by fall-planted small grains.

In order to have some insurance against yearly climatic fluctuations and to divide the time of combining, it might be desirable to plant both Ogden and S-100.

Seedbed Preparation

Careful preparation of a weed-free seedbed is one of the most important points in growing soybeans. The land should be prepared in much the same manner as for corn. The best method of preparation is to plow the land in fall or early spring and harrow or disk lightly several times before planting, to firm the seedbed and destroy as many weeds as possible. It is desirable to delay planting in the spring until at least two crops of weeds can be destroyed in this manner.

Planting

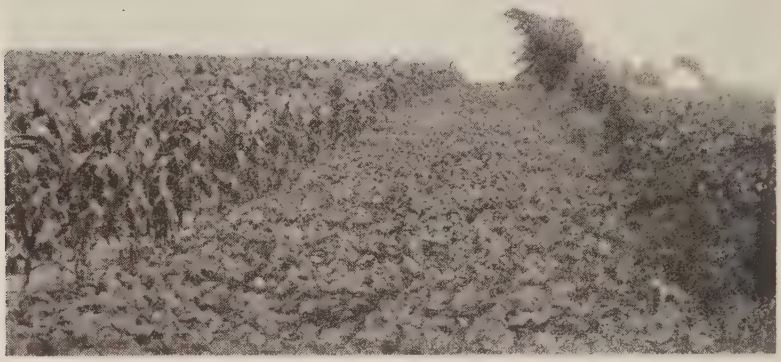
Methods

Special soybean planters, cotton planters or corn planters may be used in seeding soybeans. When the corn planter is used it should be fitted with soybean feed plates. However, if these plates are not available, corn plates can be adapted by reaming out the holes and increasing the gear ratio of the planter, or by boring extra holes to secure the desired rate of planting.

TABLE II.—Seed Yields of S-100 and Ogden Soybeans Grown at Different Locations in Oklahoma.
(Yield in bushel per acre)

Year	Stillwater		Nowata		Coweta		Wagoner	
	S-100	Ogden	S-100	Ogden	S-100	Ogden	S-100	Ogden
1949	20.0	33.0						
1948	25.0	8.9	32.9	40.0			9.8	10.6
1947	15.2	6.4						
1946*	12.7	18.7	18.0	34.0	28.0	33.9		
1946*	27.4	31.7						
1945	12.1	12.1			29.7	37.5		
1944	14.0	21.3			33.7	43.2	15.0	16.4
1943	14.0	8.1					12.1	17.2
Average	17.6	17.5	25.5	37.0	30.5	38.2	12.3	14.7

* Planted Different Dates.



Planting a border of soybeans around large corn fields is a common practice in the Corn Belt. The border plantings use the soil of the turn rows more effectively and keep weeds from invading the fields from the fence rows. The soybeans are harvested before the corn matures, which leaves the end of the rows open for easier turning of the mechanical corn pickers. (Picture courtesy U. S. Regional Soybean Laboratory.)

A grain drill may be used to plant heavy rates for forage production by stopping the unwanted holes to give the desired row spacing. In some sections of the country double-planting with a corn or cotton planter in rows 18 to 20 inches apart is used when heavy rates of seeding are necessary.

Depth of Seeding

The depth of planting is governed in general by the type of soil, and by moisture conditions. In clay loams and other heavy soils the beans should be planted about one inch deep. In light loams and sandy soils the depth of seeding can be deeper, but should not exceed three inches. Under very dry conditions the use of a furrow-opener type of seeder that plants the seed one to two inches deep in the furrow may serve to place the seed in moist soil, thus improving the conditions for prompt, uniform germination. If the seedbed becomes packed or crusted over by rain before the seedlings emerge, a light cultivation with a harrow, weeder or rotary hoe will be helpful in securing good stands.

Planting Date

Tests conducted by the Oklahoma Agricultural Experiment Station from 1944 to 1949 indicate that the best date of planting soybeans for seed production is from May 10 to June 1.

In these tests the earlier dates of planting produced a rank vegetative growth that would have been much more desirable for hay production than the later dates. This rank growth, however, made the plants more easily damaged by dry hot weather, which probably accounts for the low seed yields of the April plantings. Table III shows that S-100 and Ogden made the highest seed yields when planted May 15; while Volstate, a late maturing variety, had a

This date of planting test shows Ogden soybeans planted May 1, right, and May 22, left. The earlier date of planting made the greatest hay yield but produced less seed than the May 22 planting.

TABLE III.—Average Seed Yield of S-100, Ogden and Volstate Soybeans Planted Different Dates; 1944 to 1946, inclusive.

(Bushels per acre)

Date of Planting	S-100	Ogden	Volstate	3-yr. Av.
April 17 to 23	10.89	15.25	11.76	12.64
May 14 and 15	16.35	18.59	12.65	15.86
June 1 to 4	14.53	14.88	11.62	13.68
June 15 to 24	16.17	18.56	14.22	16.31

higher yield when planted June 15. It is interesting to note that all three varieties produced less when planted in the first week in June than they did when planted in the middle of May or the Middle of June. This is probably due to the fact that the soybeans planted in the first week in June are in their most critical period, the bloom stage, during the dry, hot days of August.

Inasmuch as the data for the years 1944 to 1946 indicated two different dates of planting, the test was redesigned to secure more reliable information. The dates of planting were narrowed to include only an early, medium and late date; and Volstate was replaced with Arksoy, a better adapted variety, which matures about the same time as Ogden. Table IV clearly indicates that the May 22 date of planting was superior to either the early or late dates.

In the six years that these tests were conducted, the oil content of the seed increased as the yields increased, except for the April plantings which produced the highest oil content with the lowest seed yields.

Rate of Planting

For Seed Production

In general, the recommended rate of planting soybeans for seed production is 24 to 30 pounds per acre in rows 36 to 42 inches apart. This rate is based on spacing plants approximately every two inches in the row on soils of average fertility. This rate should be slightly increased as the fertility level and moisture-holding capacity of the soil increases. Also, it may be necessary to increase the seeding rate to secure a good stand on a poorly prepared seedbed.

Factors such as size of seed, percent of germination, and percent of purity of the seed must be considered in determining the number of pounds of seed necessary to plant an acre. The number of seeds varies from about 2,000 per pound in some varieties to about 8,000 per pound in others. The figures at bottom of page show how this variation would affect the number of pounds of seed needed per acre for Ogden and S-100, two varieties having seed of medium size.

The percent of germination of the seed is important. Soybean seed loses its viability very quickly, and germination is usually low after two or three years unless the seed is stored under exceptionally good conditions. The grower should be sure when he purchases soybean seed that a recent germination test has been made and that the germination

Variety	Approx. no. seed per lb.	No. of pounds for 36 in. rows	No. of pounds for 42 in. rows
Ogden	3,000	29	25
S-100	3,400	26	22

is high enough to secure good stands when planted at ordinary rates. The figures given above are based on 100 percent germination, therefore it would be necessary to increase this rate to compensate for lower germination.

For Hay Production

For hay production the rate of seed- should be 40 to 60 pounds per acre. The heavier rate of seeding will not only increase forage yields, but will also produce a finer stemmed hay of better quality.

Cultivation

Soybeans, like corn, must be kept clean-cultivated and free of weeds to make profitable seed yields. Before soybeans are planted, at least one or two crops of weeds should be destroyed as soon as they begin to grow in the spring. If this recommendation is followed, the control of weeds is not a serious problem.

If weed seeds germinate or the ground forms a hard crust before the beans emerge, a shallow cultivation with a weeder, rotary hoe or spike-tooth harrow is beneficial. Cultivation should be avoided after the beans emerge and until they are about three inches in height, as they are very tender during this period and are easily injured.

When the plants have reached a height of three inches, the first cultivation can be made with one of several implements. The spike-tooth harrow is an excellent tool for this first cultivation. It should be used with the teeth slanted slightly backward, and the cultivation is more effective if made across the row or at a 45-degree angle with the row. The rotary hoe is another implement of great value in the early cultivation of soybeans and can be used until the beans are 8 to 10 inches in height. Since the rotary hoe is more efficient when pulled rapidly, it is a fast and economical method of cultivation. On light sandy soils where the rotary hoe cultivates too deeply because of its weight, a weeder is a more desirable implement.

After the plants get too high for safe use of a harrow, weeder or rotary hoe, cultivation should be continued with a regular one- or two-row cultivator as often as needed to control weeds. Cultivation should be discontinued when the plants begin to bloom, as they are easily damaged in this stage.

Soybeans should never be cultivated immediately after a rain or early in the morning when they are turgid and easily damaged.

TABLE IV.—Average Seed Yield and Oil and Protein Content of S-100, Ogden and Arksoy Soybeans Planted Different Dates; 1947 to 1949, Inclusive.

Date of Planting	Seed Yield (Bushel per acre)				Percent	Percent
	S-100	Ogden	Arksoy	Average	Oil	Protein
May 3	19.07	14.73	14.03	15.94	18.38	44.35
May 22	21.00	18.77	16.97	18.91	18.08	46.28
June 10	15.10	14.77	11.60	13.82	17.89	46.68

Harvesting

For Seed

Both of the recommended varieties (Ogden and S-100) are well adapted to combine harvesting. As the crop matures the leaves turn yellow and usually fall from the plant, leaving the bare stems and the seed pods. By the time the moisture content of the seed is low enough for combining and storage (14 percent or under) the stems and pods will usually be dry and brittle.

All soybean varieties that have been tested to date have a tendency, when grown under Oklahoma conditions, to shatter as soon as they are well matured. The crop must be inspected often and combining started as soon as the seed is mature and before shattering starts. In some seasons when moisture conditions are exceptionally favorable, there is very little shattering even two weeks after the seed is mature. However, in other seasons shattering may start while there are still some green pods on the plants.

The combine should be set according to the manufacturer's instructions and then adjusted to compensate for the moisture content of the seed. The beans have a greater tendency to split when they are dry, therefore to avoid this damage it is sometimes necessary to make adjustments on the combine as the beans become dryer during the afternoon. If the beans are very dry it is advisbale to combine only early in the morning to take advantage of a slightly increased moisture content.

Soybeans can also be harvested for seed with a grain binder in much the same manner as oats or wheat. The beans should be cut in the dough stage, which is usually about the time the leaves become dry and begin to fall off the plants. Soybeans harvested with a binder must be threshed as soon as the seed and pods are dry, as they will shatter in the shocks almost as much as they do when left in the field for combining.

For Hay

Soybeans for hay should be planted thickly to produce a high yield and a finer stemmed forage. (As stated earlier, Ogden is one of the best varieties for hay production in this State.)

The best time to harvest soybeans for hay is when the seed is about half formed and before the leaves begin to drop from the plants. The plants have reached a maximum growth at this time and, since most of the feeding value is in the seed and leaves, cutting in this stage produces the best yield of high-protein hay. Earlier harvesting may be necessary in extremely dry seasons, because the leaves may turn yellow and fall off the plants before the seeds are in the proper stage.

Soybeans for hay are generally cut with a mower, allowed to wilt in the swath for one or two days, then put into windrows or small shocks to complete the curing process. A windrow attachment may be used on the mower and the beans cured in the windrow.

Soybeans, like other large stemmed legumes, are difficult to cure properly. If the hay is not put into windrows as soon as it is well wilted, the leaves will become dry and fall off before the stems are low enough in mositure for safe storage. By leaving the hay in windrows or shocks for four or five days under good conditions, the stems can be cured with very little loss in leaves.

Hay in windrows or shocks seems to be damaged very little by rain if it is turned occasionally to dry before storage. Weathered soybean hay is not as nutritious as well cured hay; however, it has

Soybeans seeded at a heavy rate per acre, as shown in this picture, produce a good yield of high protein hay.

good feeding value and is readily eaten by all classes of livestock.

Harvesting soybean hay with a binder is also a satisfactory method. The bundles should be tied loosely and placed in small shocks to cure.

Soybean Enemies

Diseases

There has been very little disease damage on soybeans in Oklahoma up to the present time. However, diseases can be expected to become a greater problem the longer the crop is grown, and particularly if the acreage should increase.

At the present time angular leaf spot, bacteria pustule and mosaic appear to be the most prevalent diseases of soybeans in Oklahoma. For a description of these and other soybean diseases and their control, see U.S.D.A. Farmers Bulletin No. 1937, "Soybean Diseases and Their Control".

Insects

Soybeans are relatively free from serious insect damage. The grasshopper is probably the most important enemy. Leafhoppers, blister beetles, armyworms, and other caterpillars cause some damage.

Grasshoppers can be controlled by poison bran mash or by some of the new insecticides now available. Sprays and dusts containing chlordane or toxaphene (chlorinated camphene) applied directly to the infested crop by means of a power sprayer or duster or by airplane are reported as being very effective. Whether applied in a spray or dust, the active

ingredient should be used at the rate of 1 to 1½ pounds per acre in the case of chlordane and 1½ to 2 pounds in the case of toxaphene.*

Leafhoppers, blister beetles, armyworms, and other caterpillars can be controlled by applying a dust containing 2 to 3 percent of DDT in pyrophyllite, talc, or a good dusting sulfur, at the rate of 15 pounds per acre.* Armyworms may also be controlled by using poison bran mash.

Vegetation that has been treated with chlordane, toxaphene or DDT should not be fed to dairy animals at any time, and should not be fed to meat animals that are being finished for slaughter.

Rabbits

Jackrabbits are very fond of soybeans and may destroy large areas while the plants are in the seedling stage. The cottontail rabbit does not seem to be as destructive as the jackrabbit, but will cause damage wherever abundant.

Control By Poisoning**

Best results with poisoning will be obtained during the winter months, or whenever food for the rabbits is scarce. It therefore is advisable to begin the poisoning campaign before the soybeans are planted, or at any rate before they are above the ground.

Good results in poisoning jackrabbits have been obtained by inserting small quantities of powdered strychnine (alkaloid) into apples, sweet potatoes, carrots, etc., and then placing these baits at intervals along rabbit runs. The baits may be placed on sticks or wires and these set into the ground so that the bait is held at the top of the stick, three to six inches above the surface of the ground. It is essential that the baits be placed along the rabbit runs or paths. When well defined runs are not visible it is possible to make artificial ones with a narrow drag or scraper. Rabbits habitually travel along runs or even furrows, consequently they will aid in leading the rabbits to the baits.

Poisoned grain baits when properly used have likewise given good control. The most suitable grain for this purpose is oats. Whole oats are preferred to crushed oats. The poisons used in this bait is strychnine (alkaloid) powdered and formulated in accordance with the formula used in treating grain for gopher and prairiedog poison baits. The formula and directions on procedure are available on request from the Oklahoma Agricultural Experiment Station. The poisoned bait is applied along runways and along edges of the field and is placed directly on the ground on the bare soil. Poisoned grain likewise should be used prior to the time that the soybeans appear above the ground.

Another method of poisoning is by mixing one part of powdered strychnine (alkaloid) with three parts of salt. Bore four or five holes one inch deep and ¾″ in diameter into the edge of a 2 x 4 about one foot in length. Nail a cleat to the side of the 2 x 4 to make a T. Next drive the cleat into the ground so that the 2 x 4 is held on edge and the lower edge resting on the soil surface. Then fill the holes with the salt strychnine mixture. This treatment takes advantage of the jackrabbits' need and desire for salt. In order to be successful these salt baits must likewise be placed along the rabbit runways and the holes must be kept full of salt. One disadvantage of salt strychnine bait is that under Oklahoma conditions it is difficult to keep the salt in place. Wind as well as rain will add to this difficulty.

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* Morse, W. J., Cartter, J. L., Williams, L. F. *Soybeans: Culture and Varieties,* U.S.D.A. Farmers Bulletin, No. 1520. (1949.)

** Recommendations by the Entomology Department, Oklahoma A. & M. College.

In poisoning rabbits one treatment will not always suffice and it may be necessary to re-treat in order to obtain control.

Caution: Strychnine is a highly dangerous poison and is toxic to animals other than rabbits. When properly handled it is perfectly safe and useful. It must, however, be handled with extreme care. Always keep it out of reach of children, irresponsible persons, and livestock.

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